

## CHAPTER 2

# System Performance

### PERFORMANCE IN INDIVIDUAL RIVER BASINS

The major flooding—except for that on the upper Ohio River—occurred in the area served by the Harrisburg River Forecast Center. River District Offices most directly involved were WSO Richmond for the James and Appomattox; WSFO Washington for the Potomac and Rappahannock; WSO Trenton for the Schuylkill and Brandywine; RFC (RDO) Harrisburg for the Susquehanna in Pennsylvania; WSO Binghamton for the Upper Susquehanna; and WSO Rochester for the Genesee. The upper Ohio, including the Allegheny and the Monongahela, is served by the RFC Cincinnati and the WSFO (RDO) Pittsburgh.

The floods generated by Agnes demanded the maximum participation by NWS staff throughout the operational forecast system. All systems—including communications, data acquisition, data processing, and community-action programs—were strained and in some cases failed during this record catastrophe.

Performance of the system in each river basin is described in the following summaries. Various operational problems associated with flood detection and forecasting, and with alerting processes for communities, are presented in the descriptions for key locations within each river basin.

#### James River Basin (Including the Appomattox and Roanoke River Basins)

*Both flash flood warnings and forecasts of river crests were timely and allowed effective protective action. The response of local action groups was positive. In some communities, dissemination of information to the public was inadequate, because of the time-consuming nature of personal telephone communication.*

Weather forecasts for the James and Appomattox River Basins are prepared at WSFO Washington. WSO Richmond serves as the River District Office. River stage forecasts are prepared by RFC Harris-

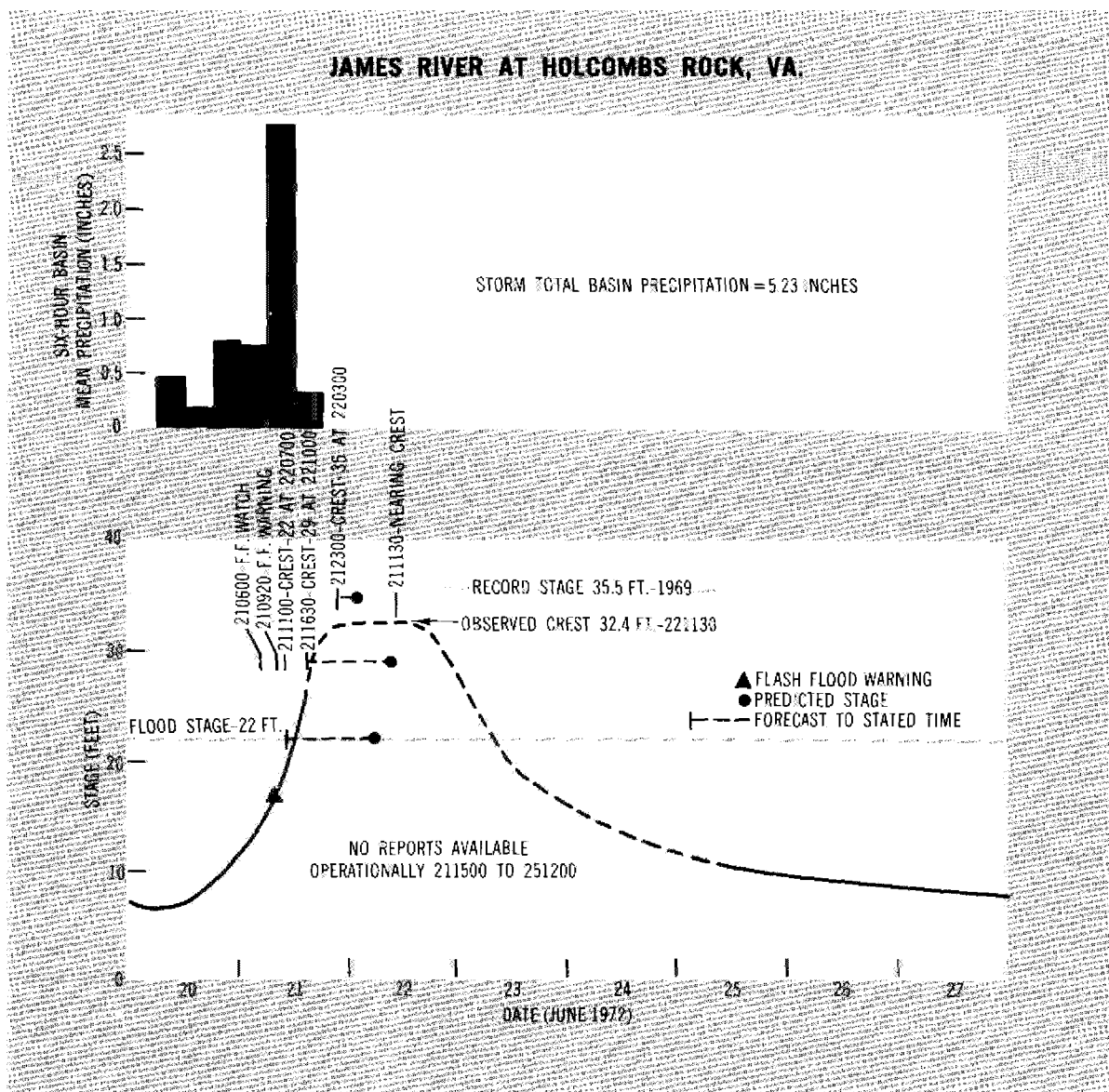
burg. Local weather summaries and flash flood watches and warnings are issued by WSFO Washington and WSOs Richmond and Lynchburg, when warranted.

WSO Richmond disseminated flood and flash flood warnings by means of local weather teletypewriter loop and telephone to the Associated Press, United Press International, Richmond radio and television stations, and civil defense and city officials. The local teletypewriter loop also was used to disseminate civil defense and City of Richmond advisories to the news media. This procedure was very effective in informing the public. The staff at Richmond was two people short during this emergency because of vacancies, but an additional meteorological technician was detailed to Richmond for the period of June 22 to 25.

WSO Lynchburg is normally a part-time station, but it went into 24-hour operation during the emergency, starting Monday, June 19. An additional meteorologist was detailed to WSO Lynchburg from WSFO Washington. To disseminate flood warnings, the Lynchburg office must place telephone calls to about 30 city, civil defense, and industry officials. The staff had great difficulty in completing these calls, and in some cases the issuance of warnings was delayed an hour or more.

The first forecast for "showers and some locally heavy thunderstorms," for the night of June 19 and all day on June 20, was issued by WSO Richmond at 5:45 p.m., June 18. Moderately heavy rains began during the evening of June 19, and rain was heavy through the afternoon and evening of June 20.

The first flood warning bulletin for the James River was issued by WSO Richmond at 10:00 a.m. on June 21. This bulletin, indicating the James River would be 2 to 3 feet above flood stage at 7:00 p.m. on June 23, was a 57-hour prediction. It was changed at 11:15 a.m. the same day to reflect a crest of 23 feet (11 feet above flood stage) on the 23d at 7:00 a.m.—serious flooding compared with that caused by Hurricane Camille in 1969. These



bulletins were revised periodically through June 22, finally reflecting a crest of 28 feet at 3:00 a.m. on June 23. The river crested at 28.6 feet on June 23 at 10:00 a.m.

Of nine river gages in the James River, seven became inoperative between 7:00 p.m. and midnight on June 21, well in advance of cresting. Flooding in downtown Richmond knocked out longline teletypewriter, local teletypewriter, and facsimile circuits for a 16½-hour period beginning at 10:30 a.m. on June 23.

In the Appomattox River Basin, no previous flood-stage base was available for determining flood impact at Petersburg. The one and only river gage ceased operating at 8:00 p.m. on June 22.

Virginia State Police reported five flood fatalities along the James River, including one person who had deliberately passed a police barricade.

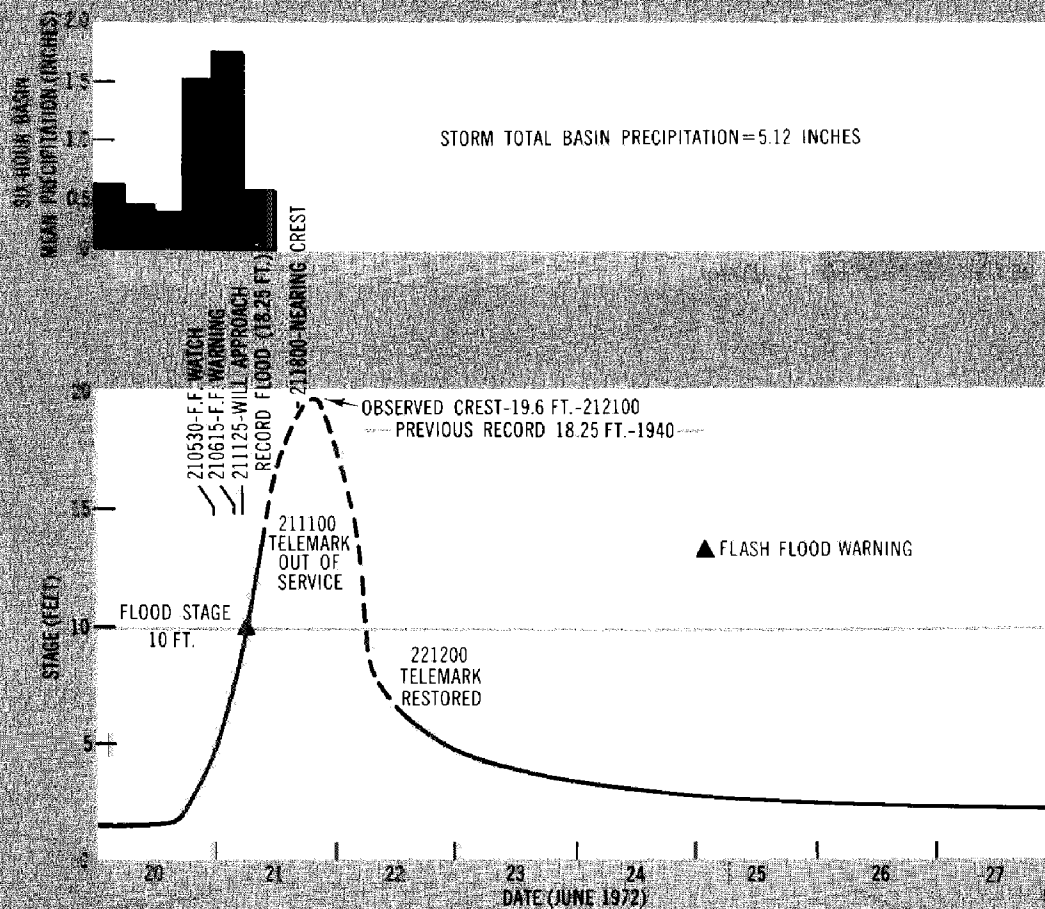
Civil defense, State, and city governments acted quickly and in the best interests of protection of life and property. Public understanding of warnings was especially good, probably as a result of experience in the 1969 Camille floods.

#### James River at Holcombs Rock, Va.

Holcombs Rock is located several miles upstream from the city of Lynchburg and below the 3,250-square-mile drainage comprising the upper James River Basin. Rain began in the upper basin on the morning of Tuesday, June 20, and continued at a moderate rate for 24 hours. During the morning of Wednesday, June 21, 2.8 inches fell in a 6-hour period, adding to the 2 inches already on the ground. The river began to rise rapidly. By midnight, it had risen 22 feet in 24 hours and was within one-half foot of the crest which occurred 12 hours later at 11:30 a.m. on Thursday, June 22. The area had



## ROANOKE RIVER AT ROANOKE, VA.



on Wednesday, June 21. Flood stage was reached 16 hours later, at 3 a.m. on Thursday, June 22.

The rise began at noon on Wednesday, June 21, and the level rose steadily for 54 hours, cresting at 4 p.m. on Friday, June 23. The level rose 36 feet and reached a maximum of 36.5 feet. This was 27.5 feet above flood stage and 8 feet above the previous flood of record set in August 1969.

Precautionary measures in Richmond were extensive and extremely well executed. An NWS bulletin issued at 11:00 p.m. on Wednesday, June 21, and calling for a 28- to 29-foot stage resulted in the city and State emergency centers being manned. Warnings were disseminated through the City Harbormaster's office. Evacuations began on the morning of Thursday, June 22, as the river—then slightly above flood stage—rose one-half foot per hour. Residents of the low-lying areas were officially served a legal order to vacate. Closures were made in the dikes early that morning. As the water rose higher, portions of the city were cordoned off

by the National Guard. Four of the five bridges across the James River were closed. During the rise, the water purification plant was inundated, and Virginia Electric Power Company lost one electric power generation station and its dispatch center. By Friday, June 23, all of downtown Richmond had ceased to operate, being without electric power, drinking water, or communications.

The City Locks river gage was inundated but not severely damaged. The telephone telemetering device (telemark) ceased to function at 4 p.m. on June 22. After that time, a leveling party from the Richmond Bureau of Survey made half-hourly readings, relating bench marks to the water surface and producing an excellent stage record.

### Roanoke River at Roanoke, Va.

Rain started in the basin on the afternoon of June 19 and was fairly light until late in the evening of June 20. Within a period of about 10 hours, ending at 7 a.m. on June 21, the basin received 3.2 inches of the 5.23-inch storm total. An extremely sharp